

**UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION**

<p>IN RE GOOGLE PLAY STORE ANTITRUST LITIGATION</p> <p>THIS DOCUMENT RELATES TO:</p> <p><i>Epic Games, Inc. v. Google LLC et al.</i>, Case No. 3:20-cv-05671-JD</p>	<p>Case No. 3:21-md-02981-JD</p> <p style="text-align: center;"><u>REDACTED VERSION</u></p>
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STATEMENT OF DR. GREGORY K. LEONARD

May 2, 2024

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I. QUALIFICATIONS

1. My name is Gregory K. Leonard. My updated curriculum vitae is attached to this submission as Appendix A.

II. ASSIGNMENT

2. I was asked by counsel for Google to review Epic's proposed injunction ("Epic's Proposal") and the associated statements by its experts and in particular to provide economic analysis of Epic's proposed regulation of the prices that Google can charge depending on whether developers use Google Play Billing (GPB) or another billing system to process purchases or subscriptions of digital content.

3. The materials I have considered in preparing this submission are listed in Appendix B and include materials previously identified in Appendix B of my November 18, 2022 Expert Report ("Leonard Report"), materials previously identified in Appendix B of my June 14, 2023 Supplemental Report ("Leonard Supplemental Report"), Epic's Proposal, the submissions of Drs. Tadelis and Bernheim and the materials cited in those submissions, and other materials cited in this submission.

III. EPIC'S PROPOSAL TO REGULATE SERVICE FEES

A. Epic's Proposal Would Impose a Price Floor on Google Play Billing

4. Under Epic's Proposal, developers would be able to use the Google Play store and process transactions for digital content using either Google Play Billing or another billing system.¹ Epic's proposed injunction would regulate the fees that Google could charge for its services depending on whether developers choose to use GPB or another billing system. Specifically, under Epic's

¹ Epic's Proposed Permanent Injunction, April 11, 2024 ("Epic's Proposal"), III.A, III.B.

Proposal, the service fee that Google charges for the services of the Play store when developers do not use GPB (i.e., the fee for non-billing services) must be less than or equal to the difference between (1) the service fee that Google charges when developers use both the Play store and GPB and (2) “Google’s average per-transaction total cost for handling in-app transactions in the preceding calendar year.”²

5. Epic’s Proposal seeks to regulate the difference between what developers pay when they use GPB and when they do not use GPB. Under Google’s User Choice Billing program, developers can offer users the choice to process transactions using GPB or another billing system. For most developers, if the user chooses GPB, the developer pays a service fee of 15%.³ If the user chooses an alternative billing system, the developer pays only 11%. Some large developers, like Epic, pay a service fee of 30% for sales of digital goods if the user chooses GPB.⁴ If that user chooses an alternative billing system, the large developer in the UCB program pays 26%. Thus, the difference between what a developer pays if GPB is used versus what a developer pays if another billing system is used is 4%.⁵

6. I understand that the jury found that GPB was a separate product from the other services provided in the Play store. Those other services provided to developers include not only app distribution, but also numerous other services such as providing tools to build and test an Android

² Epic’s Proposal, III.A.4, III.B.3. The proposal prohibits “coercive fees” on transactions that do not use GPB. “Coercive fees” are defined to be “fees that are higher than: Google’s fees for a similar transaction utilizing GPB minus Google’s average per-transaction total cost for handling in-app transactions in the preceding calendar year.” *Id.*

³ Transcript of Proceedings, *In re Google Play Store Antitrust Litigation*, 3:21-md-02981-JD, November 2, 2023-December 11, 2023 (“Trial Tr.”) (Pichai) 1394:2-13.

⁴ “Service Fees,” Google, available at <https://support.google.com/googleplay/android-developer/answer/112622?hl=en>. Ninety nine percent of the developers that are subject to a service fee pay 15% or less. Developers are charged 30% for earnings in excess of \$1 million (USD) each year.

⁵ Trial Tr. (Kochikar) 890:8-14.

app before the app is launched,⁶ providing tools to help developers successfully publish their apps once they are ready to launch,⁷ helping monitor app performance,⁸ and providing analytics.⁹ Google also helps developers measure and improve customer acquisition,¹⁰ retention and engagement,¹¹ and spending.¹² Additionally, throughout an app's lifecycle, Google also invests in and prioritizes safety¹³ and security¹⁴ to maintain a healthy business environment.

7. If GPB is considered a separate product, an economist would analyze the difference between what a developer pays if GPB is used versus what a developer pays if another billing system is used as the price of GPB. Epic's Proposal would create a floor for this price, mandating that it cannot be lower than "Google's average per-transaction total cost for handling in-app transactions in the preceding calendar year."¹⁵

⁶ "Build a high-quality app or game," Google, available at <https://play.google.com/console/about/guides/build-a-high-quality-app-or-game/>; "Internal testing," Google, available at <https://play.google.com/console/about/internal-testing/>; "Open testing," Google, available at <https://play.google.com/console/about/opentesting/>.

⁷ "Release with confidence," Google, available at <https://play.google.com/console/about/guides/releasewithconfidence/>.

⁸ "Android vitals," Google, available at <https://play.google.com/console/about/vitals/>.

⁹ "Statistics," Google, available at <https://play.google.com/console/about/stats/>.

¹⁰ "Grow your audience," Google, available at <https://play.google.com/console/about/guides/growyouraudience/>.

¹¹ "Engage and retain your users," Google, available at <https://play.google.com/console/about/guides/engage-and-retain-your-users/>.

¹² "Price in-app products with confidence by running price experiments in Play Console," Android Developers Blog, May 10, 2023, available at <https://android-developers.googleblog.com/2023/05/price-experiments-in-play-console.html>.

¹³ "Play Commerce prevented over \$2 billion in fraudulent and abusive transactions in 2022," Android Developers Blog, March 23, 2023, available at <https://android-developers.googleblog.com/2023/03/play-commerce-prevented-fraudulent-and-abusive-transactions-in-2022.html>.

¹⁴ "Overview of the Play Integrity API," Android Developers, available at <https://developer.android.com/google/play/integrity/overview>.

¹⁵ Epic's Proposal, p. 9. Epic's Proposal can also be viewed as setting a cap on the price Google charges for Play non-billing services, conditional on the price it charges for Play with GPB.

B. Potential Pitfalls of Price Regulation

8. In general, price regulation is fraught with potential inefficiencies: the regulator generally has imperfect information about economic conditions (such as demand and costs) and may be unable to modify the regulations to respond to changes in market conditions.¹⁶ Setting prices too low or too high can lead to inefficient economic outcomes. For example, setting the price of a regulated product too high may lead to inefficiently low consumption of the product; setting the price too low may reduce incentives of producers to invest in product quality. Accordingly, in market-based economies, the preference is for prices to be determined by the market. The market generally does a better job than a regulator of setting efficient prices, particularly where economic conditions are changing.

9. These economic principles mean that Epic's Proposal to regulate Google's service fees presents a significant risk of creating inefficiencies that harm developers and consumers. To mitigate those risks, the Court would have to oversee highly detailed calculations of Google's costs. But as discussed in greater detail below, given the costs involved and Epic's proposal, it is highly unlikely as a matter of economics that the harms from inaccurate price regulation could be avoided.

10. Suppose that the price floor is calculated using an incorrectly high estimate of the cost of GPB of 6% when the correct figure is in fact 4%. In that scenario, Google would have several options for complying with the proposed floor. First, it could keep the service fee for Play when GPB is not used at 11% as it is under UCB and increase the service fee for Play when GPB is used

¹⁶ See, e.g., D. Carlton and J. Perloff, *Modern Industrial Organization* (4th Ed., 2005), pp. 682-706; C. Winston, "U.S. Industry Adjustment to Economic Deregulation," *Journal of Economic Perspectives* (1998).

to 17% (versus 15% if the correct 4% floor had been set). This would harm developers by increasing prices.

11. Second, Google could stop offering the costliest forms of payment (see below for a discussion of this issue) to reduce the average cost of processing in the next calendar year, thereby reducing the floor. This would harm developers and consumers by reducing the available choices of forms of payment.

12. Third, Google could comply with the price floor by keeping the service fee for Play when GPB is used the same and decrease the service fee for Play when GPB is not used. In this scenario, Epic's Proposal would effectively set a cap on what Google can charge for Play without GPB. However, I understand Epic's Proposal with respect to fees is designed to address Google's conduct in what the jury found to be the "Android In-App Payment Solution Market." Any such remedy should not affect what Google can charge for Play's services other than GPB, which under Epic's trial theory, are for services in a separate market. Rather, those price should be set by the market.¹⁷ Forcing Google to make an artificial price reduction below the market value of its services would make it difficult for other app stores to compete because they would have to reduce the price of their own service below its value. Moreover, capping Google's service fee below its market value would reduce Google's incentives to invest in innovation because it could not earn a full return on its investment.

13. There are several reasons why Epic's Proposal is likely to result in errors that harm competition by regulating Google's service fees.

¹⁷ Epic has proposed separate remedies to address that alleged market. In addition, I understand Google has entered into a settlement with the States that addresses the conduct Epic claimed was anticompetitive in that market.

1. Basing the Floor on Average Total Cost Would Set the Floor Too High

14. Epic’s Proposal uses a problematic measure of costs. It would set the price floor for GPB at Google’s average per-transaction *total* cost. However, there is a long history in antitrust economics of using average *variable* cost rather than average total cost as the standard for “below cost” or predatory pricing.¹⁸ There are a number of reasons for this.

15. Variable costs are those costs that vary with the firm’s output. Total costs are variable costs plus “fixed” costs that do not vary with the firm’s output (at least over the relevant ranges of output). For transactions processing, an example of a variable cost is the interchange fee paid to a credit card network for each credit card transaction. An example of a fixed cost is the cost involved in negotiating contracts for additional forms of payment and incorporating those forms of payment into a billing system. Because average total cost, by definition, exceeds average variable cost, setting a price floor for GPB equal to average total cost will force Google to maintain a higher price than setting the floor equal to average variable cost.

16. One reason for using average variable cost as the standard is that it is less likely to chill legitimate price competition than using average total cost. The economics literature recognizes this risk.¹⁹ For example, because average total cost exceeds average variable cost, setting the price floor equal to average total cost may prevent Google from engaging in pro-competitive price cuts in response to rivals that were below its average total costs.

¹⁸ See, e.g., Carlton and Perloff (2005), p. 357; W. Baumol, “Predation and the Logic of the Average Variable Cost Test,” *Journal of Law and Economics* (1996); S. Salop, “Refusals to Deal and Price Squeezes By An Unregulated, Vertically Integrated Monopolist,” *Antitrust Law Journal* (2010); K. Elzinga and D. Mills, “Predatory Pricing,” in *The Oxford Handbook of International Antitrust Economics*, Vol. 2 (2015).

¹⁹ See, e.g., Baumol (1996) and Elzinga and Mills (2015).

17. Setting the price floor equal to average variable cost has an even stronger rationale here given that many of Google’s putative billing services rivals already have a transaction processing business of their own, e.g., Square, Stripe, and PayPal.²⁰ Such companies likely will be able to use their own infrastructure and other fixed costs to provide billing services for apps downloaded from the Play store without incurring additional fixed costs to process those transactions. In that case, average variable cost is the more relevant cost measure than average total cost because it is a better representation of the cost that the company would need to cover when processing additional transactions to make entry into billing services for Android apps profitable.²¹

18. For example, suppose that a firm that is considering entering the market has an existing processing business with fixed costs of \$1 million and average variable costs per transaction of 2.5%. Because the firm will incur the \$1 million fixed costs regardless of whether it enters, it would be profitable to enter the market as long as the firm could charge a price for those transactions above its 2.5% average variable cost per transaction. In that scenario, the firm would, on average, make more revenue for every additional transaction it processes than it costs to process that transaction.

19. A further rationale for using average variable cost is that it is generally more straightforward to calculate than average total cost. For firms such as Google with multiple products, many fixed costs are “joint and common” to multiple products. In general, there is no standard economic way to allocate such costs across products. Rather, the appropriate allocation

²⁰ Statement of Steven Tadelis on Behalf of Epic Games, Inc, April 11, 2024 (“Tadelis Statement”), ¶ 5, footnote 11; Trial Tr. (Tadelis) 2535:1-7, 2549:19-25, 2553:1-6.

²¹ While some firms may desire to set up their own billing systems from scratch, they may be less efficient entrants than firms that already have billing systems. Any price floor on the GPB price should be designed to allow only equally (or more) efficient billing system rivals to compete with GPB, not less efficient rivals.

method will depend on the context.²² Moreover, potentially appropriate allocation methods that have been developed are often difficult to implement in practice.²³ I understand that Google does not attempt any allocations in the ordinary course of business.²⁴ Both Epic and Google retained accounting experts who testified at trial and disputed the proper allocation of a number of common costs across Google businesses.²⁵ Thus, requiring an allocation of joint and common costs in this litigation setting is likely to result in substantial areas of dispute that the Court would need to resolve each year.

2. Complexities Created By Differences Among Forms of Payment

20. Epic's Proposal ignores complexities created by differences in forms of payment. GBP supports a variety of forms of payment (FOPs).²⁶ When a user initiates a transaction using GBP in Play, GPB allows the user to choose among various FOPs, including credit cards, debit cards, PayPal, e-wallets,²⁷ "direct carrier billing" (DCB),²⁸ and Play-branded gift cards.²⁹

²² H. Young, "Cost Allocation," in *Handbook of Game Theory*, Vol. 2 (1994), p. 1230.

²³ *Id.*

²⁴ Trial Tr. (Skinner) 2347:3-17 (explaining reasons not to allocate shared or joint costs among individual products that benefit from those costs).

²⁵ Trial Tr. (Barnes) 2331:22-2332:1; Trial Tr. (Skinner) 2346:13-2748:14.

²⁶ Trial Tr. (Loew) 3129:24-3132:13 (describing forms of payments supported by Google Play Billing and the payment fees incurred, including processing fees to payment vendors), 3144:8-12 ("[W]hen a user goes through a purchase flow and they purchase something, the money gets remitted to Google; and then what we do is we deduct any applicable taxes and our service fee, and then we give the rest to the developer on a monthly basis"). GPB is not itself a payment processor. Rather, Google contracts with third-party processing companies to process the transactions through GPB.

²⁷ E-wallet payment refers to Google Pay, which "allows customers to load credit or debit cards from participating banks and financial institutions onto their phone. They can then use these cards for Google Play store purchases." See "Transactions on Google Play," Google Partner Marketing Hub, available at <https://partnermarketinghub.withgoogle.com/brands/google-play/overview/transactions-on-google-play/>.

²⁸ Direct carrier billing "allow[s] customers to add purchases on Google Play to their mobile phone bill." See "Transactions on Google Play," Google Partner Marketing Hub, available at <https://partnermarketinghub.withgoogle.com/brands/google-play/overview/transactions-on-google-play/>.

²⁹ Not all FOPs are offered in every country.

21. Play gift cards and DCB are fundamentally different than the other FOPs (credit cards, debit cards, and e-wallets, including PayPal) because they involve more than transaction processing.³⁰ Branded gift cards provide additional value to the brand, such as marketing and building user loyalty and must be distributed via, for example, retail outlets.³¹ Thus, the costs that Google incurs for Play-branded gift cards are, in part, payment for marketing and brand-building for the Play store. Similarly, the fees that Google pays for DCB transactions pursuant to contracts with carriers appear to be consideration for carrier obligations that go beyond transaction processing.³²

22. Neither the proposed injunction nor Dr. Tadelis addresses this issue or explains what portion of the Play gift card and DCB costs should be considered “cost[s] for handling in-app transactions,” as opposed to payments for other valuable services or products. However, without addressing this issue, including gift card and DCB costs would overstate the “cost[s] for handling in-app transactions.” Doing so would result in a price floor that was too high, which would harm developers and consumers for the reasons discussed above.

23. For example, a 2021 Google document cited by Dr. Tadelis states that the global cost of FOPs other than gift cards and DCB is 2.6%, while the cost of all FOPs (including gift cards and DCB) is a significantly higher, at 5.6%.³³ The figures for the U.S. are 3.0% (excluding gift cards

³⁰ Trial Tr. (Loew) 3131:24-3132:11.

³¹ See, e.g., J. Offenberg, “Markets: Gift Cards,” *Journal of Economics Perspectives* (2007), p. 229.

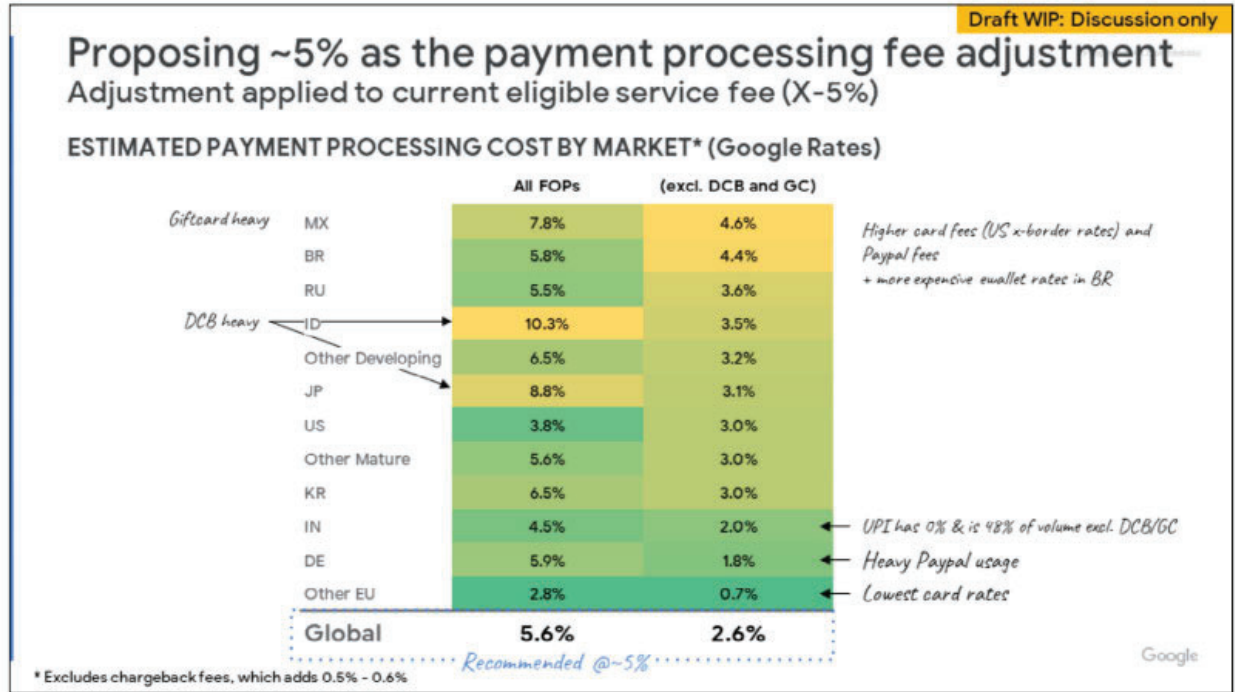
³²

[REDACTED]

See also Trial Tr. (Loew) 3131:24-3132:11.

³³ Trial Exhibit 2698-046. Dr. Tadelis cites this document for the proposition that Google’s processing costs are 5.6%. However, Dr. Tadelis has made no attempt to determine the portion of the gift card and DCB costs that is attributable to transactions processing.

and DCB) and 3.8% (all FOPs). Thus, Google's costs are substantially lower for the other FOPs than for gift cards and DCB.³⁴



24. In principle, one could try to limit gift card and DCB costs to the portion that represents the “cost[s] for handling in-app transactions.” However, this approach would require performing a detailed analysis and allocation of gift card and DCB costs. For DCB, it would require analysis and interpretation of contracts with over 180 carrier partners.³⁵ As noted above, there is no standard economic way to allocate these costs and economists and accountants are likely to dispute any allocation similar to how they disputed the allocation of costs at trial.

25. The practical approach would be to exclude gift card and DCB transactions from any calculation of average costs. However, the slide that Dr. Tadelis relies upon suggests that there is

³⁴ The document also indicates that costs associated with credit card processing “may decline in the future.” Trial Exhibit 2698-047.

³⁵ Trial Tr. (Loew) 3131:6-10.

no need for any injunction if these costs are excluded because the average processing costs for all other transactions is less than the 4% effective price for GPB under the UCB program. I explain in the next Section why this means that a rival billing service could compete while still covering its costs.

3. Basing the Current Year Floor on Prior Year's Costs Could Create Distortions

26. Epic's Proposal would set the price floor for GPB in the current year based on the prior year's average total cost. Because different FOPs have different costs, changes over time in the mix of transactions across the different FOPs can change the overall weighted average cost of handling in-app transactions. For example, suppose that 10% of transaction volume in 2024 is through high-cost FOPs such as DCB, but that share of transaction volume declines to 5% over the course of 2025. In that scenario, the price floor for GPB will be calculated using an average cost that is higher than the average cost in the marketplace when the price floor is in effect. The result will be an artificially high price floor, which raises prices and harms developers and consumers for the reasons set forth above.

4. Google May Be Induced to Stop Offering High-Cost FOPs

27. Epic's Proposal may create conditions that would lead Google to drop certain FOPs altogether, reducing consumer choice. Rivals would have incentives not to offer high-cost FOPs because this would reduce their own costs and drive up Google's costs, increasing the price floor and requiring Google to raise prices the following year. This in turn increases the spread between the price floor and low-cost FOPs, increasing the incentives of rivals to saddle Google with high-cost FOPs while offering their customers low-cost FOPs. Google would have a strong economic incentive to avoid this situation by matching its competitors' strategy and ceasing to support high-

cost FOPs in GPB. This outcome would harm those consumers who prefer to use direct carrier billing.

C. Epic's Proposal is Unnecessary for Rival Billing Systems to Compete

28. Dr. Tadelis asserts that the price floor provision is necessary to stop Google from “prevent[ing] equally-efficient or more-efficient Alternative In-App Payment Solutions from competing with Google on the merits.”³⁶ That assertion is not correct.

29. As noted above, if GPB is a separate product, an economist would consider Google's price for GPB under User Choice Billing to be 4%. Epic's proposed price floor is unnecessary if rival billing systems can price at or below 4% while still covering their costs. The evidence I have reviewed indicates that rival billing systems can do so for the large majority of transactions.

30. The Google document cited by Dr. Tadelis states that Google's costs of processing are lower than 4% for the FOPs other than gift cards and DCB (see above). Thus, an equally efficient rival would also have costs less than 4% and could therefore compete for transactions with FOPs other than gift cards and DCB.

31. Rivals would be able to compete with GPB without supporting gift cards and DCBs. The large majority of transactions via GPB used credit cards, debit cards, or PayPal.³⁷ Thus, a rival could compete for most transactions even if it limited its FOP offerings to credit cards, debit cards, and e-wallets. Moreover, rivals, by definition, will not offer Play-branded gift cards,³⁸ and many may choose not to offer DCB given its high costs and relatively low usage.

³⁶ “Tadelis Statement”, ¶ 22.

³⁷ For example, in 2021 in the U.S., 87.3% of net consumer spend on Google Play's billing system was via “CARD” and “PAYPAL” form of payments. See Google's App-level Spend Data, Consumers, GOOG-PLAY-005535886 and GOOG-PLAY-010801688. See also Trial Tr. (Loew) at 3132:21.

³⁸ Play-branded gift cards can only be used in Google Play's billing system. Trial Tr. (Loew) 3130:14-17.

32. Other evidence is consistent with the proposition that rival billing systems have costs less than the current 4% effective price of GPB that Epic’s Proposal seeks to regulate. Mr. Sweeney of Epic testified that Epic would pay fees of 2%-4% to other entities for “the equivalent [to GPB] payment service.”³⁹ Ben Simon, CEO and President of Yoga Buddhi Co., testified when users sign up for its app Down Dog on the web using PayPal or their credit card, Yoga Buddhi pays “roughly 3 percent” to process those transactions.⁴⁰ A witness from Netflix testified it was “paying 3 percent.”⁴¹ Spotify data showed that Spotify’s processing costs were less than 3% in 2020 and 2021 (the last two years provided).⁴² [REDACTED]

[REDACTED] This evidence from developers confirms that rivals likely would have costs less than Google.

33. In sum, contrary to Dr. Tadelis’ assertion that price regulation is necessary to ensure “[competition] with Google on the merits,”⁴⁴ a rival billing service could charge a price that is higher than its processing costs but lower than the 4% price of GPB under Google’s current pricing system. Accordingly, an equally efficient rival billing system could offer a price for its services

³⁹ Trial Tr. (Sweeney) 2028:22-25. See also Trial Tr. (Sweeney) 2084:6-9 (testifying that Epic’s payment processing costs are “3 percent”).

⁴⁰ Trial Tr. (Simon) 291:4-9.

⁴¹ Perryman Trial Testimony by Video Deposition, *In re Google Play Store Antitrust Litigation*, 3:21-md-02981-JD November 9, 2023, 66:8-11.

⁴² Trial Exhibit 2062-001.

⁴³ [REDACTED]

⁴⁴ Tadelis Statement, ¶¶ 16, 22.

that is competitive with the additional cost to developers of using GPB under Google's current UCB pricing structure.

IV. EPIC'S PROPOSAL TO PROHIBIT GOOGLE FROM USING ANDROID APIs THAT ALLOW DEVELOPERS TO AUTOMATICALLY REPORT TRANSACTIONS

34. Epic's Proposal includes a provision that would prohibit Google from using APIs to "invoke" alternative billing systems that process transactions on which it can collect service fees.⁴⁵ This would prevent APIs that, for example, allow developers to automatically report transactions to Google⁴⁶ so that Google can charge a service fee, which Epic's injunction would allow Google to do. Dr. Tadelis asserts that this provision would prevent Google from degrading alternative billing systems.⁴⁷ However, such degradation concerns are entirely speculative. In contrast, the efficiency benefits of using APIs that allow developers to automatically report transactions are concrete.

35. When developers use GPB, Google can automatically calculate and deduct the service fees it is owed. Under Epic's proposed injunction, Google would be able to charge service fees for the services of the Play store when developers sell digital content through other billing systems. To ensure that it receives all of these service fees, developers must have some way to report transactions on which they owe service fees. Google has APIs that do this automatically using computer code,⁴⁸ reducing the need for developers to retain records and the need for developers and Google to conduct audits that can give rise to disputes about what fees are owed.

⁴⁵ Epic's Proposal, p. 10.

⁴⁶ "Alternative billing APIs," Android Developers, available at <https://developer.android.com/google/play/billing/alternative>.

⁴⁷ Tadelis Statement, ¶ 21.

⁴⁸ "Alternative billing APIs," Android Developers, available at <https://developer.android.com/google/play/billing/alternative>.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

A handwritten signature in black ink, appearing to read "Greg K Leonard", written over a horizontal line.

Executed on this 2nd day of May in Hillsborough, California.

Appendix A



Gregory K. Leonard
Vice President

PhD, Economics
Massachusetts Institute of Technology
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Dr. Gregory K. Leonard is a vice president in the Antitrust & Competition Economics Practice of CRA. He specializes in applied microeconomics and econometrics. He has provided testimony before US federal and state courts, government agencies, and arbitration panels on issues involving antitrust, damages estimation, statistics and econometrics, surveys, valuation, and labor market discrimination.

Dr. Leonard has written extensively in the areas of antitrust, industrial organization, econometrics, intellectual property, class certification, and labor economics. His publications have appeared in journals such as the *RAND Journal of Economics*, the *Journal of Industrial Economics*, the *Journal of Econometrics*, the *International Journal of Industrial Organization*, and the *Antitrust Law Journal*, among others. Dr. Leonard's writings were cited by the Court of Appeals for the Federal Circuit in its *Uniloc* decision and his trial testimony was cited by the Supreme Court in its *Oracle v. Google* decision. He is the Editorial Board Vice Chair for Economics of the *Antitrust Law Journal* and has served as a referee for numerous economic journals.

Dr. Leonard has given invited presentations on antitrust and intellectual property issues at the (US) Federal Trade Commission, the US Department of Justice, the former Anti-Monopoly Bureau of China's Ministry of Commerce, the Supreme People's Court of China, and Japan's Fair Trade Commission. He served as a consultant on the issue of immunities and exemptions to the (US) Antitrust Modernization Commission.

Papers and publications

"A Proposed Method for Measuring Competition Among Imperfect Substitutes." With J. Hausman and D. Zona. *Antitrust Law Journal* 60, 1992, pp. 889-900.

"Issues in the Contingent Valuation of Environmental Goods: Methodologies for Data Collection and Analysis." With D. McFadden. In *Contingent Valuation: A Critical Assessment*, ed. by J. A. Hausman, North Holland Press, 1993.

"Assessing Use Value Losses Due to Natural Resource Injury." With J. Hausman and D. McFadden. In *Contingent Valuation: A Critical Assessment*, ed. by J. A. Hausman, North Holland Press, 1993.

"Does Contingent Valuation Measure Preferences? Experimental Evidence." With P. Diamond, J. Hausman, and M. Denning. In *Contingent Valuation: A Critical Assessment*, ed. by J. A. Hausman, North Holland Press, 1993.

“Competitive Analysis with Differentiated Products.” With J. Hausman and D. Zona. *Annales d'Economie et de Statistique* 34, 1994, pp. 159-180.

“A Utility Consistent, Combined Discrete Choice and Count Data Model: Assessing Recreational Use Losses Due to Natural Resource Damage.” With J. Hausman and D. McFadden. *Journal of Public Economics* 56, 1995, pp. 1-30.

“Market Definition Under Price Discrimination.” With J. Hausman and C. Vellturo. *Antitrust Law Journal* 64, 1996, pp. 367-386.

“Achieving Competition: Antitrust Policy and Consumer Welfare.” With J. Hausman. *World Economic Affairs* 1, 1997, pp. 34-38.

“Economic Analysis of Differentiated Products Mergers Using Real World Data.” With J. Hausman. *George Mason Law Review* 5, 1997, pp. 321-346.

“Superstars in the NBA: Economic Value and Policy.” With J. Hausman. *Journal of Labor Economics* 15, 1997, pp. 586-624.

“Efficiencies From the Consumer Viewpoint.” With J. Hausman. *George Mason Law Review* 7, 1999, pp. 707-727.

“Documents Versus Econometrics in Staples.” With J. Hausman. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1305691.

“The Competitive Effects of a New Product Introduction: A Case Study.” With J. Hausman. *Journal of Industrial Economics* 30, 2002, pp. 237-263.

“Does Bell Company Entry into Long-Distance Telecommunications Benefit Consumers?” With J. Hausman and J. G. Sidak. *Antitrust Law Journal* 70, 2002, pp. 463-484.

“On Nonexclusive Membership in Competing Joint Ventures.” With J. Hausman and J. Tirole. *RAND Journal of Economics* 34, 2003.

“Correcting the Bias When Damage Periods are Chosen to Coincide With Price Declines.” With D. Carlton. *Columbia Business Law Review*, 2004, pp. 304-306.

“Competitive Analysis Using a Flexible Demand Specification.” With J. Hausman. *Journal of Competition Law and Economics* 1, 2005, pp. 279-301.

“Using Merger Simulation Models: Testing the Underlying Assumptions.” With J. Hausman. *International Journal of Industrial Organization* 23, 2005, pp. 693-698.

“Application of Empirical Methods in Merger Analysis.” With C. Dippon and L. Wu. Report to the Fair Trade Commission of Japan, June 27, 2005.

“A Practical Guide to Damages.” With L. Stiroh. In *Economic Approaches to Intellectual Property, Policy, Litigation and Management*, ed. by G. Leonard and L. Stiroh, 2005.

“Applying Merger Simulation Techniques to Estimate Lost Profits Damages in Intellectual Property Litigation.” In *Economic Approaches to Intellectual Property, Policy, Litigation and Management*, ed. by G. Leonard and L. Stiroh, 2005.

“Antitrust Implications of Pharmaceutical Patent Litigation Settlements.” With R. Mortimer. In *Economic Approaches to Intellectual Property, Policy, Litigation and Management*, ed. by G. Leonard and L. Stiroh, 2005.

“Framework for Policymakers to Analyze Proposed and Existing Antitrust Immunities and Exemptions.” With D. Bush and S. Ross. Report to the Antitrust Modernization Commission, October 24, 2005.

“Real Options and Patent Damages: The Legal Treatment of Non-Infringing Alternatives and Incentives to Innovate.” With J. Hausman. *Journal of Economic Surveys* 20, 2006, pp. 493-512 (reprinted in *Economic and Legal Issues in Intellectual Property*, M. McAleer and L. Oxley, eds., Blackwell Publishing, 2007).

“The Competitive Effects of Bundled Discounts.” In *Economics of Antitrust: Complex Issues in a Dynamic Economy*, ed. by L. Wu, 2007.

“Estimation of Patent Licensing Value Using a Flexible Demand Specification.” With J. Hausman. *Journal of Econometrics* 139, 2007, pp. 242-258.

“Patent Damages and Real Options: How Judicial Characterization of Non-Infringing Alternatives Reduces Incentives to Innovate.” With J. Hausman and J. G. Sidak. *Berkeley Technology Law Journal* 22, Spring 2007, pp. 825-853.

“Don’t Feed the Trolls.” With N. Attenborough and F. Jimenez. *les Nouvelles*, Vol. 42, September 2007, pp. 487-495 (reprinted in *Patent Trolls: Legal Implications*, C.S. Krishna, ed., The Icfai University Press, 2008). With J. Johnson, C. Meyer, and K. Serwin.

“Are Three to Two Mergers in Markets with Entry Barriers Necessarily Problematic?” *European Competition Law Review* 28, October 2007, pp. 539-552. With N. Attenborough and F. Jimenez

“Economics and the Rigorous Analysis of Class Certification in Antitrust Cases.” With L. Wu. *Journal of Competition Law and Economics* 3, 2007, pp. 341-356. With J. Johnson.

“Assessing the Competitive Effects of a Merger: Empirical Analysis of Price Differences Across Markets and Natural Experiments.” *Antitrust*, Fall 2007, pp. 96-101.

“A Comparison of the Almost Ideal Demand System and Random Coefficients Logit Models For Use with Retail Scanner Data.” With F. Deng. Working Paper, 2007.

"Incentives and China's New Antimonopoly Law." With F. Deng. *Antitrust*, Spring 2008, pp. 73-77.

"Use of Simulation in Competitive Analysis." With J.D. Zona. In *Issues in Competition Law and Policy*, ed. by W. Dale Collins, 2008.

"Allocative and Productive Efficiency." With F. Deng. In *Issues in Competition Law and Policy*, ed. by W. Dale Collins, 2008.

"In the Eye of the Beholder: Price Structure as Junk Science in Antitrust Class Certification Proceedings." With J. Johnson. *Antitrust*, Summer 2008, pp. 108-112.

"Merger Retrospective Studies: A Review." With G. Hunter and G. S. Olley. *Antitrust*, Fall 2008, pp. 34-41.

"Roundtable Discussion: Developments—and Divergence—in Merger Enforcement." *Antitrust*, Fall 2008, pp. 9-27.

"Dispatch From China." *Antitrust*, Spring 2009, pp. 88-89.

"A Hard Landing in the Soft Drink Market – MOFCOM's Veto of the Coca-Cola/Huiyuan Deal." With F. Deng and A. Emch. *Antitrust Chronicle*, April 2009(2).

"Predatory Pricing after *linkline* and *Wanadoo*." With A. Emch. *Antitrust Chronicle*, May 2009(2).

"Farrell and Shapiro: The Sequel." With M. Lopez. *Antitrust*, Summer 2009, pp. 14-18.

"掠夺性定价—美国与欧盟的法律及经济学分析" ("Predatory Pricing – Economics and Law in the United States and the European Union"), 法学家 (*Jurists' Review*), 2009, pp. 100-110. With A. Emch.

"Revising the Merger Guidelines: Second Request Screens and the Agencies' Empirical Approach to Competitive Effects." With L. Wu. *Antitrust Chronicle*, December 2009(1).

"How Private Antitrust Litigation May Be Conducted in China." With F. Deng and W. Tang. *Competition Law* 360, January 6, 2010.

"Merger Screens: Market-Share Based Approaches and 'Upward Pricing Pressure,'" *Antitrust Source*, February 2010. With E. Bailey, G. S. Olley, and L. Wu.

"Minimum Resale Price Maintenance: Some Empirical Evidence From Maryland." With E. Bailey. *BE Journal of Economic Analysis & Policy* 10, 2010.

"Three Cases Reshaping Patent Licensing Practice." With E. Bailey and A. Cox. *Managing Intellectual Property*, March 2010.

"Econometrics and Regression Analysis." With J. Langenfeld, W. Li, and J. Morris. in *Proving Antitrust Damages: Legal and Economic Issues*, ABA Section of Antitrust (2nd Edition), 2010.

“Patent Damages: What Reforms Are Still Needed?.” With M. Lopez. *Landslide* 2, May/June 2010.

“The Google Books Settlement: Copyright, Rule 23, and DOJ Section 2 Enforcement.” *Antitrust*, Summer 2010, pp. 26-31.

“The 2010 Merger Guidelines: Do We Need Them? Are They All We Need?.” *Antitrust Chronicle*, October 2010(2).

“Evaluating the Unilateral Competitive Effects of Mergers Among Firms with High Profit Margins.” With E. Bailey and L. Wu. *Antitrust*, Fall 2010, pp. 28-32.

“Predatory Pricing in China—In Line With International Practice?.” With A. Emch. *Legal Issues of Economic Integration* 37, 2010, pp. 305-316.

“What Can Be Learned About the Competitive Effects of Mergers From ‘Natural Experiments’?.” With G. S. Olley. *International Journal of the Economics of Business* 18, 2011, pp. 103-107.

“District Court Rejects the Google Books Settlement: A Missed Opportunity?.” *Antitrust Source*, April 2011.

“Making Sense of ‘Apportionment’ in Patent Damages.” With E. Bailey and M. Lopez. *Columbia Science and Technology Law Review* 12, pp. 255-271, 2011.

“Rigorous Analysis of Class Certification Comes of Age.” With J. Johnson. *Antitrust Law Journal* 77, 2011, pp. 569-586.

“Economic Analysis in Indirect Purchaser Class Actions.” With F. Deng and J. Johnson. *Antitrust*, Fall 2011, pp. 51-57.

“Merger Assessment and Frontier of Economic Analyses (4): Empirical Methods in Antitrust Merger Review.” With L. Wu. *Kokusai Shoji Houmu (International Business Law and Practice)*, Vol. 40, No. 3, 2012, pp. 391-401.

“Merger Assessment and Frontier of Economic Analyses (5): Empirical Methods in Antitrust Merger Review.” With L. Wu. *Kokusai Shoji Houmu (International Business Law and Practice)*, Vol. 40, No. 4, 2012, pp. 557-564.

“Merger Assessment and Frontier of Economic Analyses (6): Empirical Methods in Antitrust Merger Review.” With L. Wu. *Kokusai Shoji Houmu (International Business Law and Practice)*, Vol. 40, No. 5, 2012, pp. 731-739.

“Economists’ Roundtable on Hot Patent-Related Antitrust Issues.” With D. Carlton, C. Meyer, C. Shapiro. *Antitrust*, Summer 2013, pp. 10-21.

“Not So Natural Experiments.” *Competition Policy International*, July 2013 (2).

“The Role of China’s Unique Economic Characteristics in Antitrust Enforcement.” With F. Deng. In *China’s Anti-Monopoly Law: The First Five Years*, ed. by Adrian Emch and David Stallibrass, 2013.

“Reflections on Bazaarvoice.” With P. Normann. *CPI Antitrust Chronicle*, March 2014 (1).

“An Introduction to Econometric Analysis.” In *Econometrics: Legal, Practical and Technical Issues*, ABA Section of Antitrust (2nd Edition), 2014.

“The Econometric Framework.” in *Econometrics: Legal, Practical and Technical Issues*, ABA Section of Antitrust (2nd Edition), 2014.

“Applying Econometrics to Estimate Damages.” With J. Langenfeld, W. Li, and J. Morris. in *Econometrics: Legal, Practical and Technical Issues*, ABA Section of Antitrust (2nd Edition), 2014.

“Determining RAND Royalties for Standard-Essential Patents.” With M. Lopez. *Antitrust*, Fall 2014, pp. 86-94.

“Reflections on the Debates Surrounding Standard-Essential Patents.” *The Antitrust Source*, August 2015.

“Turning Daubert on Its Head: Efforts to Banish Hypothesis Testing in Antitrust Class Actions.” *Antitrust*, Spring 2016, pp. 53-59.

“Roundtable with Economists: Discussing Practice and Theory with the Experts.” With D. Carlton, P. Johnson, M. Maher, and C. Shapiro. *Antitrust*, Spring 2018, pp. 11-23.

“Comparative Analysis of Court-Determined FRAND Royalty Rates.” With F. Deng and M. Lopez. *Antitrust*, Summer 2018, pp. 47-51.

The *Illinois Brick* Damages Edifice: Demolition or Deconstruction?,” *Antitrust Law Journal*, Vol. 84, 2022.

Presentations

“Merger Analysis with Differentiated Products,” paper presented to the Economic Analysis Group of the US Department of Justice, April 1991 (with J. Hausman and D. Zona).

“Assessing Use Value Losses Due to Natural Resource Injury,” paper presented at “Contingent Valuation: A Critical Assessment,” Cambridge Economics Symposium, April 3, 1992 (with J. Hausman and D. McFadden).

“Contingent Valuation and the Value of Marketed Commodities,” paper submitted to the Contingent Valuation Panel of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, August 12, 1992 (with J. Hausman).

“Economic Analysis of Differentiated Products Mergers Using Real World Data,” paper presented to the George Mason University Law Review Antitrust Symposium, October 11, 1996 (with J. Hausman).

“Documents Versus Econometrics in Staples,” paper presented to a program of the Economics Committee of the ABA Antitrust Section, September 5, 1997 (with J. Hausman).

Discussant, “New Developments in Antitrust” session, AEA meetings, January 7, 2000.

“In Defense of Merger Simulation,” Department of Justice and Federal Trade Commission Merger Workshop, Unilateral Effects Session, February 18, 2004.

Discussant, “Proving Damages in Difficult Cases: Mock Trial & Discussion,” NERA Antitrust & Trade Regulation Seminar, July 10, 2004.

“Network Effects, First Mover Advantage, and Merger Simulation in Damages Estimation,” LSI Workshop on Calculating and Proving Patent Damages, July 16, 2004.

“Early Exchange of Documents,” LSI Workshop on Pre- and Early Stage Patent Litigation, July 23, 2004.

“Lessons Learned From Problems With Expert Testimony: Antitrust Suits,” LSI Workshop on Effective Financial Expert Testimony, November 4, 2004.

“Price Erosion and Convoyed Sales,” LSI Workshop on Calculating & Proving Patent Damages, January 19, 2005.

“Economic Analysis of Rule 23(b)(3),” LSI Litigating Class Action Suits Conference, June 6, 2005.

“Early Exchange of Documents,” LSI Workshop on Pre- & Early-Stage Patent Litigation, July 22, 2005.

“Issues to Consider in a Lost Profits Damages Analysis,” Patent Litigation 2005, Practicing Law Institute, September 30, 2005.

“Antitrust Issues in Standard Setting and Patent Pools,” Advanced Software Law and Practice Conference, November 3, 2005.

“New Technologies for Calculating Lost Profits,” LSI Workshop on Calculating & Proving Patent Damages, February 27, 2006.

“Estimating Antitrust Damages,” Fair Trade Commission of Japan, April 21, 2006.

“Economic Analysis of Rule 23(b)(3),” LSI Litigating Class Action Suits Conference, May 11, 2006.

“Permanent Injunction or Damages: What is the Right Remedy for Non-Producing Entities?,” San Francisco Intellectual Property Law Association/Los Angeles Intellectual Property Law Association Spring Seminar, May 20, 2006.

“Antitrust Enforcement in the United States” and “Economic Analysis of Mergers,” Sino-American Symposium on the Legislation and Practice of Anti-Trust Law, Beijing Bar Association, Beijing, People’s Republic of China, July 17, 2006.

“Economic Analysis in Antitrust,” Chinese Academy of Social Sciences, Beijing, People’s Republic of China, July 20, 2006.

“Issues to Consider in a Lost Profits Damages Analysis,” Patent Litigation 2006, Practicing Law Institute, September 26, 2006.

“Comparison of the Almost Ideal Demand System and Random Coefficient Models for Use With Retail Scanner Data,” Pacific Rim Conference, Western Economic Association, Beijing, People’s Republic of China, January 12, 2007 (with F. Deng).

Discussant, “Applied Economics” Session, Pacific Rim Conference, Western Economic Association, Beijing, People’s Republic of China, January 12, 2007.

“Balancing IPR Protection and Economic Growth in China,” International Conference on Globalization and the Protection of Intellectual Property Rights, Chinese University of Political Science and Law, Beijing, People’s Republic of China, January 20, 2007.

“The Use and Abuse of Daubert Motions on Damages Experts: Lessons from Recent Cases,” LSI Workshop on Calculating & Proving Patent Damages, February 27, 2007.

“Will Your Licenses Ever be the Same? Biotechnology IP Strategies,” BayBio 2007 Conference, April 26, 2007.

“Tension Between Antitrust Law and IP Rights,” Seminar on WTO Rules and China’s Antimonopoly Legislation, Beijing, People’s Republic of China, September 1, 2007.

“Issues to Consider in a Lost Profits Damages Analysis,” Patent Litigation 2007, Practicing Law Institute, September 25, 2007.

Discussant, “Dominance and Abuse of Monopoly Power” Session, China’s Competition Policy and Anti-Monopoly Law, J. Mirrlees Institute of Economic Policy Research, Beijing University, and the Research Center for Regulation and Competition, Chinese Academy of Social Sciences, Beijing, People’s Republic of China, October 14, 2007.

“Opening Remarks,” Seminar on China’s Anti-monopoly Law and Regulation on Abuse of Intellectual Property Rights, Beijing, People’s Republic of China, April 26, 2008.

"Issues to Consider in a Reasonable Royalty Damages Analysis," Patent Litigation 2008, Practising Law Institute, October 7, 2008.

"Econometric Evaluation of Competition in Local Retail Markets," Federal Trade Commission and National Association of Attorneys General Retail Mergers Workshop, December 2, 2008,

"Merger Review Best Practices: Competitive Effects Analysis," International Seminar on Anti-Monopoly Law: Procedure and Substantive Assessment in Merger Control, Beijing, People's Republic of China, December 15-17, 2008.

"The Use of Natural Experiments in Antitrust," Renmin University, Beijing, People's Republic of China, December 18, 2008.

"China's Antimonopoly Law: An Economist's Perspective," Bloomberg Anti-Monopoly Law of China Seminar, January 29, 2009.

Panelist, "Standards for Assessing Patent Damages and Their Implementation by Courts," FTC Hearings on the Evolving IP Marketplace, February 11, 2009.

"Economic Analysis of Agreements Between Competitors" and "Case Study: FTC Investigates Staples' Proposed Acquisition of Office Depot," Presentation to Delegation of Antitrust Officials from the People's Republic of China, Washington, DC, March 23, 2009.

"Reasonable Royalties in the Presence of Standards and Patent Pools," LSI Workshop, April 20, 2009.

Presentations on Unilateral Effects, Buyer Power, and the Intellectual Property-Antitrust Interface to Delegation from the Anti-Monopoly Bureau of MOFCOM of the People's Republic of China, Washington, DC, May 10-11, 2009.

Panelist, "The Use of Economic and Statistical Models in Civil and Criminal Litigation," Federal Bar Association, San Francisco, May 13, 2009.

"Trends in IP Rights Litigation and Economic Damages in China," Pursuing IP in the Pacific Rim, May 14, 2009.

Presentation on the Economics of Antitrust, National Judicial College of the People's Republic of China, Xi'an, People's Republic of China, May 25-26, 2009.

"Case Study: The Use of Economic Analysis in Merger Review," Presentation to the Anti-Monopoly Bureau of MOFCOM, Beijing, People's Republic of China, May 27, 2009.

"Economics and Antitrust Law," China University of Political Science and Law, Beijing, People's Republic of China, September 21, 2009.

"Case Study: Economic Analysis of Coordinated Interaction," Presentation to the Anti-Monopoly Bureau of MOFCOM, Beijing, People's Republic of China, September 22, 2009.

“Relevant Market Definition,” 4th Duxes Antitrust Law Seminar, Beijing, People’s Republic of China, September 26, 2009.

“Expert Economic Testimony in Antitrust Litigation,” Supreme People’s Court, Beijing, People’s Republic of China, February 2, 2010.

“New Case Law for Patent Damages,” Law Seminars International Telebriefing, April 28, 2010.

“China/India: Sailing in Uncharted Waters: Regulating Competition in the Emerging Economies – New Laws, New Enforcement Regimes and No Precedents,” The Chicago Forum on International Antitrust Issues, Northwestern University School of Law Searle Center, May 20, 2010.

“Antitrust and Intellectual Property,” Supreme People’s Court, Beijing, People’s Republic of China, May 26, 2010.

“Cartel Enforcement Trends in the United States,” 2nd Ethical Beacon Anti-Monopoly Summit, Beijing, People’s Republic of China, May 27, 2010.

Panelist, “The Future of Books and Digital Publishing: the Google Book Settlement and Beyond,” 2010 American Bar Association Annual Meeting, August 7, 2010.

“Coordinated Effects” and “Non-Horizontal Mergers,” Presentations to Delegation from India Competition Commission, US Chamber of Commerce, Washington, DC, October 26, 2010.

“UPP and Merger Simulation,” Annual Conference of the Association of Competition Economics, Norwich, UK, November 11, 2010.

“Uniloc v. Microsoft: A Key Ruling For Patent Damages,” Law Seminars International Telebriefing, January 21, 2011.

“Correlation, Regression, and Common Proof of Impact,” New York City Bar Association, January 19, 2011.

“Private Litigation Under China’s New Antimonopoly Law,” Bar Association of San Francisco, February 17, 2011.

“Competition Law and State Regulation: Setting the Stage and Focus on State-Owned Enterprises,” Competition Law and the State: International and Comparative Perspectives, Hong Kong, People’s Republic of China, March 18, 2011.

Panelist, “Booking it in Cyberspace: The Google Book Settlement and the Aftermath,” American Intellectual Property Law Association, San Francisco, May 13, 2011.

“Econometric Estimation of Cartel Overcharges,” ZEW Conference on Economic Methods and Tools in Competition Law Enforcement, Mannheim, Germany, June 25, 2011.

Panelist, "Antitrust and IP in China," Antitrust and IP in Silicon Valley and Beyond, American Bar Association and Stanford University, Palo Alto, October 6, 2011.

Panelist, University of San Diego School of Law Patent Law Conference: The Future of Patent Law Remedies, January 18, 2013.

"Economics Framework," US-China Workshop on Competition Law and Policy for Internet Activities, China's State Administration for Industry and Commerce (SAIC) and the U.S. Trade and Development Agency (USTDA), Shenzhen, People's Republic of China, June 4-5, 2013.

Panelist, "China Inside and Out," American Bar Association, Beijing, People's Republic of China, September 16-17, 2013.

Panelist, "Remedies in Patent Cases," Fifth Annual Conference on The Role of the Courts in Patent Law & Policy, Berkeley and Georgetown Law Schools, November 1, 2013.

"Royalty Base," Leadership Conference, Qualcomm Incorporated, March 21, 2014.

"Reflections on Natural Experiments," DG Comp, April 8, 2014.

Panelist, "Antitrust in Asia: China," American Bar Association Section of Antitrust Law, Beijing, People's Republic of China, May 21-23, 2014.

Panelist, "Patent Damages Roundtable," 2015 Intellectual Property Institute, University of Southern California Gould School of Law, Los Angeles, March 23, 2015.

Panelist, "IP and Antitrust – The Current State of Economic Analysis," Global Competition Review Live 2nd Annual IP & Antitrust USA, Washington, DC, April 14, 2015.

Panelist, "FRAND Royalty Rates After Ericsson v. D-Link," American Bar Association, May 15, 2015.

Participant, Patent Damages Workshop, University of California-Berkeley, March 3, 2016.

Panelist, "FRANDtopia – In a Perfect World," LAIPLA Spring Conference, May 5, 2018.

Panelist, "Chicago Forum on International Antitrust Issues," Northwestern Pritzker School of Law, June 15, 2018.

Panelist, "Competition in Digital Advertising: Is There Online and Offline Convergence?," Challenges to Antitrust in a Changing Economy, Harvard Law School, November 8, 2019.

Testimonies given in the last five years

In the Matter of: Determination of Rates and Terms for Making and Distributing Phonorecords (Phonorecords III), before the Copyright Royalty Board Library of Congress, Docket No. 16-CRB-0003-PR (2018-2022), 2017-2022 (Reports, Deposition, Trial Testimony).

Plexxikon Inc. v. Novartis Pharmaceuticals Corporation, United States District Court for the Northern District of California, Case No. 4:17-CV-04405-HSG (EDL), 2019 (Deposition), 2021 (Trial Testimony).

Press Ganey Associates, Inc. v. Qualtrics, LLC, American Arbitration Association, Case No. 01-18-0004-4674, 2019 (Deposition).

In the Matter of: Determination of Rates and Terms for Digital Performance of Sound Recordings and Making of Ephemeral Copies to Facilitate those Performances (Web V), before the United States Copyright Royalty Board Library of Congress, Docket No. 19-CRB-0005-WR (2021-2025), 2020 (Deposition, Trial Testimony).

Abiomed Inc. v. Maquet Cardiovascular LLC, United States District Court for the District of Massachusetts, Case No. 1:16-cv-10914-FDS, 2020 (Deposition).

Network-1 Technologies, Inc. v. Google LLC, United States District Court for the Southern District of New York, Case No. 1:14-cv-09558, 2020 (Deposition).

3Shape A/S v. Align Technology, Inc., United States District Court for the District of Delaware, Civil Action No. 18-886-LPS-CJB, 2020 (Deposition).

District Council #16 Northern California Health & Welfare Trust Fund v. Sutter Health, et al, No. RG15753647, 2021 (Deposition).

In the Matter of Certain Digital Video-Capable Devices and Components Thereof, Investigation No. 337-TA-1224, United States International Trade Commission, 2021 (Deposition).

Teradata US, Inc., Teradata Corporation and Teradata Operations, Inc. v. SAP SE, SAP America, Inc. and SAP Labs LLC, United States District Court for the Northern District of California, Case No. 3:18-cv-03670-WHO, 2021 (Depositions).

American Society of Composers, Authors and Publishers v. Radio Music License Committee, Arbitration, 2021 (Hearing Testimony).

PureWick Corporation v. Sage Products, LLC, United States District Court for the District of Delaware, Case No. 1:19-cv-01508-MN, 2021 (Deposition), 2022 (Trial Testimony).

In Re Caustic Soda Antitrust Litigation, United States District Court for the Western District of New York, Case No. 1:19-cv-003895-EAW-MJR, 2022 (Deposition).

Bedford, Freeman & Worth Publishing Group, LLC d/b/a Macmillan Learning, Macmillan Holdings, LLC, Cengage Learning, LLC, Elsevier Inc., Elsevier B.V., McGraw Hill LLC, and Pearson Education Inc. v. Shopify, Inc., United States District Court for the Eastern District of Virginia, Case 1:21-cv-01340, 2022 (Deposition).

Athos Overseas, Ltd. v. YouTube, LLC and Google LLC, United States District Court for the Southern District of Florida, Miami Division, Case No. 1:21-cv-21698-DPG, 2022 (Deposition).

In Re Google Play Store Antitrust Litigation, United States District Court for the Northern District of California, San Francisco Division, Case No. 3:21-md-02981-JD, Case No. 3:21-cv-05227, 2023 (Deposition, Trial Testimony).

Broadcom Corporation, et al. v. Netflix, Inc., United States District Court for the Northern District of California, Case No. 3:20-cv-04677-JD (N.D. Cal.), 2023 (Deposition).

Professional activities

Member, American Economic Association

Member, Econometric Society

Member, American Bar Association

Contributor, www.antitrust.org

Contributor, ABA Section of Antitrust Law, *Econometrics*, 2005

Associate Editor, *Antitrust*, 2007-2010

Senior Editor, *Antitrust Law Journal*, 2012-; Associate Editor, 2010-2012

Co-Editor, ABA Section of Antitrust Law Economics Committee Newsletter, 2009-2012

Member, Economics Task Force, ABA Section of Antitrust Law, 2011-2012

Member, ABA Delegation to International Seminar on Anti-Monopoly Law: Procedure and Substantive Assessment in Merger Control, Beijing, People's Republic of China, December 15-17, 2008.

Member, Working Group for drafting the "Joint Comments of the American Bar Association Section of Antitrust Law and Section of International Law on the MOFCOM Draft Guidelines for Definition of Relevant Markets," 2009.

Member, Working Group for drafting the "Joint Comments of the American Bar Association Section of Antitrust Law and Section of International Law on the SAIC Draft Regulations on the Prohibition of Acts of Monopoly Agreements and of Abuse of Dominant Market Position," 2009.

Member, Working Group for drafting the “Joint Comments of the American Bar Association Section of Antitrust Law and Section of International Law on the SAIC Draft Regulations on the Prohibition of Acts of Monopoly Agreements and of Abuse of Dominant Market Position,” 2010.

Referee: *Econometrica*, *Review of Economics and Statistics*, *International Journal of Industrial Organization*, *Review of Industrial Organization*, *Journal of Sports Economics*, *Journal of Environmental Economics and Management*, *Research in Law and Economics*, *Labour Economics*, *Eastern Economic Journal*, *Journal of Forensic Economics*, *Antitrust*, *Antitrust Law Journal*, *Journal of Competition Law and Economics*, *Advances in Econometrics*.

Professional history

12/2019–Present	<i>Vice President</i> , Charles River Associates
2012–2019	<i>Partner</i> , Edgeworth Economics
2008–2012	<i>Senior Vice President</i> , NERA Economic Consulting
2004–2008	<i>Vice President</i> , NERA Economic Consulting
2000–2004	<i>Senior Vice President</i> , Lexecon, Inc.
1991–2000	<i>Director</i> , Cambridge Economics, Inc.
1990–1991	<i>Senior Analyst</i> , NERA Economic Consulting
1989–1990	<i>Assistant Professor</i> , Columbia University
	<ul style="list-style-type: none"> • Econometrics • Statistics • Labor Economics

Appendix B

Appendix B Documents Relied Upon

Bates-Numbered Documents

GOOG-PLAY-005535886
GOOG-PLAY-010801688

GOOG-PLAY-001507814

GOOG-PLAY-003604574

Case Documents

Epic's Proposed Permanent Injunction, April 11, 2024.

Statement of B. Douglas Bernheim on Behalf of Epic Games, Inc, April 11, 2024.

Statement of Steven Tadelis on Behalf of Epic Games, Inc, April 11, 2024.

Transcript of Proceedings, *In re Google Play Store Antitrust Litigation*, 3:21-md-02981-JD, November 2, 2023-December 11, 2023.

Trial Exhibit 2062.

Trial Exhibit 2698.

Expert Reports

Expert Report of Steven Schwartz, Ph.D., October 3, 2022.

Academic Articles

Baumol, William J., "Predation and the Logic of the Average Variable Cost Test," *Journal of Law and Economics*, Vol. 39, No.1, 1996, pp. 49-72.

Carlton, Dennis and Jeffrey Perloff, *Modern Industrial Organization*, 4th Edition, Pearson, 2005.

Elzinga, Kenneth G. and David Mills, "Predatory Pricing," in *The Oxford Handbook of International Antitrust Economics*, Vol. 2, 2015, pp. 40-61.

Offenberg, Jennifer Pate, "Markets: Gift Cards," *Journal of Economics Perspectives*, Vol. 21, No. 2, 2007, pp. 227-238.

Salop, Steven C., "Refusals to Deal and Price Squeezes by an Unregulated, Vertically Integrated Monopolist," *Antitrust Law Journal*, Vol. 76, No. 3, 2010, pp. 709-740.

Winston, Clifford, "U.S. Industry Adjustment to Economic Deregulation," *Journal of Economic Perspectives*, Vol. 12, No. 3, 1998, pp. 89-110.

Young, H.P., "Cost Allocation," in *Handbook of Game Theory*, Vol. 2, 1994, pp. 1193-1235.

Websites

"Alternative billing APIs," Android Developers, available at <https://developer.android.com/google/play/billing/alternative>.

"Android vitals," Google, available at <https://play.google.com/console/about/vitals/>.

"Build a high-quality app or game," Google, available at <https://play.google.com/console/about/guides/build-a-high-quality-app-or-game/>.

"Engage and retain your users," Google, available at <https://play.google.com/console/about/guides/engage-and-retain-your-users/>.

"Grow your audience," Google, available at <https://play.google.com/console/about/guides/growyouraudience/>.

“Internal testing,” Google, available at <https://play.google.com/console/about/internal-testing/>.

“Open testing,” Google, available at <https://play.google.com/console/about/opentesting/>.

“Overview of the Play Integrity API,” Android Developers, available at <https://developer.android.com/google/play/integrity/overview>.

“Play Commerce prevented over \$2 billion in fraudulent and abusive transactions in 2022,” Android Developers Blog, March 23, 2023, available at <https://android-developers.googleblog.com/2023/03/play-commerce-prevented-fraudulent-and-abusive-transactions-in-2022.html>.

“Price in-app products with confidence by running price experiments in Play Console,” Android Developers Blog, May 10, 2023, available at <https://android-developers.googleblog.com/2023/05/price-experiments-in-play-console.html>.

“Release with confidence,” Google, available at <https://play.google.com/console/about/guides/releasewithconfidence/>.

“Service Fees,” Google, available at <https://support.google.com/googleplay/android-developer/answer/112622?hl=en>.

“Statistics,” Google, available at <https://play.google.com/console/about/stats/>.

“Transactions on Google Play,” Google Partner Marketing Hub, available at <https://partnermarketinghub.withgoogle.com/brands/google-play/overview/transactions-on-google-play/>.